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TRANSMITTAL OF APPEAL BRIEF (Large Entity)	Docket No. L9289.00121

In Re Application Of: Kuniyuki KAJITA

OIPE
OCT 26 2005
PATENT & TRADEMARK OFFICE
IAP3

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
09/701,433	November 29, 2000	Phung Chung	24257	2133	9782

Invention: RADIO COMMUNICATION APPARATUS AND CODING PROCESSING METHOD

COMMISSIONER FOR PATENTS:

Transmitted herewith in triplicate is the Appeal Brief in this application, with respect to the Notice of Appeal filed on

Attention
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Dated: October 26, 2005

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Before the Board of Appeals and Interferences

In re the Application of

Inventors: Kuniyuki KAJITA

Appln No.: 09/701,433

Filed: NOVEMBER 29, 2000

For: RADIO COMMUNICATION APPARATUS AND CODING PROCESSING METHOD

APPEAL BRIEF

On Appeal From Group Art Unit 2133

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TABLE OF CASES

I. REAL PARTY IN INTEREST

The real party in interest is the assignee of the present application, Matsushita Electric Industrial Co., Ltd., of Osaka Japan.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

III. STATUS OF CLAIMS

Claims 1-44 have been presented for examination. Claims 1-10, 14-18, and 26-30 have been canceled. Claims 11-13, 19-25, 31-44 are pending, stand finally rejected and form the subject matter of the present appeal. A Notice of Panel Decision from Pre-Appeal Brief Review maintained the final rejection of all claims.

IV. STATUS OF AMENDMENTS

There was no amendment filed after the final rejection of April 20, 2005.

V. SUMMARY OF THE SUBJECT MATTER CLAIMED

The present invention is directed to providing a radio communication apparatus with a coding processing method which achieves high resistivity to burst error in the propagation path. The present invention was conceived due to the inventor's insight that the prior art technique, described at application pages 1-5 and shown in Figs. 1A, 1B and 2, suffers burst errors due to increased bits being partial to a portion within a frame. As

discussed at application page 5, line 9 through page 6, line 6, the present inventor recognized that this problem occurs as a result of the timing of the repetition and interleaving processing in the prior art technique, where repetition processing of all of the data is performed prior to interleaving. The concept of the present invention is to alter this timing so that there is repetition after interleaving, to yield a well-balanced condition of increased bits from the repetition within the frame.

The first embodiment of the invention is illustrated in Figs. 3A-9 and discussed at application page 8, line 6 *et seq*. Fig. 9 (discussed at application page 19, line 23 *et seq*.) shows that bits d4 and d5 are repeated after the interleaving step. This prevents the bits increased due to repetition from being partial to one position within a frame and enables an improved bit error rate, as discussed at application page 22, line 17 through page 23, line 15. The third embodiment is illustrated in Figs. 11A and 11B discussed at application page 26, line 5 *et seq*. This embodiment includes repetition solely after the interleaving.

Independent claim 11 recites a radio transmission apparatus as shown in Fig. 11A, comprising a coder 101 that performs error correction coding of input data including a plurality of bits; an interleaver 104 that performs interleaving of the bits coded by the coder 101; and a rate matcher 105 that comprises a repeater and a

puncturer, wherein the rate matcher alternatively selects between (i) employing the repeater to repeat a part of the bits interleaved by the interleaver and (ii) employing the puncturer to puncture a part of the bits interleaved by the interleaver. See application page 1, lines 15 through 20 for a discussion of rate matching that includes repetition and puncturing.

Claim 12 depends from claim 11 and states that the coder 101 performs the error correction coding of the input data to provide error correction coded data and the interleaver 104 performs the interleaving of the error correction coded data.

Claim 13 depends from claim 11 and states that the repeat and the puncture of the part of the bits are performed at regular intervals. See for example Fig. 9.

Independent claim 19 recites a radio transmission method comprising (a) performing error correction coding of input data including a plurality of bits; (b) performing interleaving of the bits coded in step (a); (c) employing a rate matcher that comprises a repeater and a puncturer to alternatively select between (i) using the repeater to repeat a part of bits interleaved in step (b) and (ii) using the puncturer to puncture a part of the bits interleaved in step (b); and (d) transmitting data including bits provided by the rate matcher in step (c). This method is

illustrated in Figs. 11A and 11B and discussed at application page 26, line 5 *et seq*.

Claim 20 recites a radio reception method best illustrated in Fig. 11B, comprising (a) receiving data including a plurality of bits transmitted by the radio transmission method of claim 19; (b) employing a second rate matcher that comprises a second repeater and a second puncturer to alternatively select between (i) using the second repeater to repeat bits punctured by the puncturer employed in the radio transmission method and (ii) using the second puncturer to puncture bits repeated by the repeater employed in the radio transmission method; and (c) performing deinterleaving of data including bits provided by the second rate matcher in step (b), in accordance with the interleaving performed in the radio transmission apparatus.

Claim 21 depends from claim 11 and recites that the rate matcher performs adjustment of a length of data interleaved by the interleaver. See, for example, application page 9, line 20 *et seq*.

Claim 22 depends from claim 11 and recites a transmitter that transmits data including bits provided by the rate matcher. This is illustrated, for example, in Fig. 11A.

Independent claim 23 recites a radio transmission apparatus illustrated in Fig. 11A, comprising a coder 101 that performs error correction coding of input data including a plurality of bits; an

interleaver 104 that performs interleaving of the bits coded by the coder; and a rate matcher 105 that repeats a part of bits interleaved by the interleaver. See application page 1, lines 15 through 20 for a discussion of rate matching that includes repetition and puncturing.

Claim 24 depends from claim 23 and recites that the coder 101 performs the error correction coding of the input data to provide error correction coded data, and the interleaver 104 performs the interleaving of the error correction coded data.

Claim 25 depends from claim 23 and recites that the rate matcher repeats the part of bits at regular intervals. See for example Fig. 9.

Independent claim 31 recites a radio transmission method comprising (a) performing error correction coding of input data including a plurality of bits; (b) performing interleaving of the bits coded in step (a); (c) employing a rate matcher that repeats a part of bits interleaved in step (b); and (d) transmitting data including bits provided by the rate matcher in step (c). This is illustrated in Fig. Fig. 11A.

Claim 32 recites a radio reception method comprising (a) receiving data including a plurality of bits transmitted by the radio transmission method of claim 31; (b) employing a second rate matcher that punctures bits repeated by the rate matcher employed

in the radio transmission method; and (c) performing deinterleaving of data including bits provided by the second rate matcher in step (b), in accordance with the interleaving performed in the radio transmission apparatus. This is illustrated in Fig. 11B.

Claim 33 depends from claim 23 and recites that the second rate matcher performs adjustment of a length of data interleaved by the interleaver. See, for example, application page 9, line 20 *et seq*.

Claim 34 depends from claim 23 and recites a transmitter that transmits data including bits provided by the rate matcher. This is illustrated, for example, in Fig. 11A.

Claim 35 recites a radio reception apparatus comprising a receiver that receives data including a plurality of bits transmitted from the radio transmission apparatus of claim 22; a second rate matcher that comprises a second repeater and a second puncturer, wherein the second rate matcher alternatively selects between (i) employing the second repeater to increase bits punctured by the puncturer of the radio transmission apparatus and (ii) employing the second puncturer to puncture bits repeated by the repeater of the radio transmission apparatus; and a deinterleaver that performs deinterleaving of data including bits provided by the rate matcher of the radio reception apparatus, in accordance with the interleaving performed in the radio

transmission apparatus. This is illustrated for example in Fig. 11B.

Claim 36 defines a communication terminal apparatus comprising the radio transmission apparatus of claim 22. See for example Fig. 11B.

Claim 37 defines a communication terminal apparatus comprising the radio reception apparatus of claim 35. See for example Fig. 11B.

Claim 38 defines a base station apparatus comprising the radio transmission apparatus of claim 22. See for example Fig. 11A.

Claim 39 defines a base station apparatus comprising the radio reception apparatus of claim 35. See for example Fig. 11A.

Claim 40 recites a radio reception apparatus comprising a receiver that receives data including a plurality of bits transmitted from the radio transmission apparatus of claim 34; a second rate matcher that puncture bits repeated by the repeater of the radio transmission apparatus; and a deinterleaver that performs deinterleaving of data including bits provided by the second rate matcher, in accordance with the interleaving performed in the radio transmission apparatus. See for example Fig. 11B.

Claim 41 defines a communication terminal apparatus comprising the radio transmission apparatus of claim 34. See for example Fig. 11A.

Claim 42 defines a communication terminal apparatus comprising the radio reception apparatus of claim 40. See for example Fig. 11B.

Claim 43 defines a base station apparatus comprising the radio transmission apparatus of claim 34. See for example Fig. 11A.

Claim 44 defines a base station apparatus comprising the radio reception apparatus of claim 40. See for example Fig. 11B.

The references above to the specification and drawings are for illustrative purposes only and are not intended to limit the scope of the invention to the referenced embodiments.

VI. ISSUES

Whether claims 11-13, 19, 21-25, 31, 33, 34, 36, 38, 41 and 43 stand correctly rejected under 35 U.S.C. §103(a) as unpatentable over Chen et al. (US 6,199,186) in view of Frenger et al. ("Rate Matching in Multi-Channel Systems Using RCPC-Codes").

Whether claims 20, 32, 35, 37, 39, 40, 42, 44 stand correctly rejected under 35 USC 103(a) as unpatentable over Chen et al. (US 6,199,186) in view of Frenger et al. ("Rate Matching in Multi-Channel Systems Using RCPC-Codes") further in view of the applicant's admitted prior art (Figs. 1A, 1B and 2).

VII. GROUPING OF CLAIMS

Independent claims 11 and 19 and dependent claims 12, 13, 21, 22, 36 and 38 stand or fall together. Claims 20, 35 , 37 and 39

stand or fall together. Independent claims 23 and 31 and dependent claims 24, 25, 33, 34, 41 and 43 stand or fall together. Claims 32, 40, 42 and 44 stand or fall together. Each of the above groups of claims stand or fall separately relative to the other groups.

VII. ARGUMENT

It is submitted that the features discussed below are clearly not disclosed or suggested by the applied art whether considered alone or in combination.

A. The Invention

The present invention provides a radio communication apparatus with a coding processing method which achieves high resistivity to burst error in the propagation path. The present invention was conceived due to the inventor's insight that the admitted prior art technique, described at application pages 1-5 and shown in Figs. 1A, 1B and 2, suffers burst errors due to increased bits being partial to a portion within a frame. The present inventor recognized that this problem occurs as a result of the timing of the repetition and interleaving processing in the prior art technique, where repetition processing of all of the data is performed prior to interleaving. The concept of the present invention is to alter this timing so that there is repetition after interleaving, to yield a well-balanced condition of increased bits from the repetition within the frame. The present invention also is

directed to a receiver that performs reception processing of the above-described transmission data.

More particularly, each of independent claims 11, 19, 23, 31 recites, *inter alia*, in the following order, first, error correction coding, then, interleaving, and then, rate matching. Independent claims 11 and 19 further recite that the rate matching includes alternatively selecting between (i) repeating a part of the interleaved bits and (ii) puncturing a part of the interleaved bits.

B. The Applied References

Chen's FIG. 1 shows a system wherein ECC encoded symbols from convolutional encoder 114 are interleaved in interleaver 115 and then applied to modulator 116. As noted by the Final Rejection, Chen lacks a teaching of rate matching. The Final Rejection relies on Frenger for a teaching of rate matching.

Frenger discloses a convolutional encoder, specifically, a rate-compatible punctured convolutional (RCPC) encoder. This is defined as a convolutional encoder with a set of puncturing matrices. For purposes of showing the superiority of the RCPC-coding scheme, Frenger also discusses an alternative convolutional coder using a fixed convolutional code that is concatenated with a repetition code for rate matching purposes. Thus, Frenger discloses two different convolutional encoders with embedded rate matching. What the final rejection deems a "rate matcher" in

Frenger is actually a convolutional encoder including a rate matching function. Although the exact meaning of rate matching in Frenger is different from that of the present claimed invention, hereinafter we use the word "rate matching" in a general sense as meaning (1) both repetition and puncture, (2) repetition only or (3) puncture only. Contrary to the position taken in the final rejection, Frenger does not disclose a <u>single device</u> employing both RCPC-codes (puncturing) and a fixed convolutional code concatenated with a repetition code (repeating).

Frenger is <u>primarily</u> directed to a convolutional encoder with embedded rate matching. Frenger discusses "interleaving" only <u>incidentally</u> (see for example page 355, first column, line 12). While mentioning interleaving, he does not discuss any relationship between the interleaving and the convolutional encoding, much less the order or timing of these operations. It is clear that, if any order is adopted by Frenger with respect to the coding and the interleaving, it is to perform interleaving after coding.
Frenger's order would involve rate-matching then interleaving for the reasons that (a) he discloses "puncturing" that is performed <u>within</u> the channel "coding" scheme which is based on RCPC encoding, thus permitting an interleaver to operate only on the output of the RCPC encoder, and (b) he discusses "repeating" involving a

convolutional encoder concatenated with a repetition encoder, thus excluding an interleaver interposed between the concatenated convolutional encoder and repetition encoder.

That this is the order of operations in Frenger is further shown by the Hagenauer article ("Rate-Compatible Punctured Convolutional Codes (RCPC Codes) and their Applications"), which is foundational to and cited in the Frenger article. (A copy thereof was submitted with the Response filed July 19, 2005.) The cited paper by Hagenauer provides the fundamental concept of the RCPC coding discussed in Frenger. In other words, the RCPC code used in Frenger was originally disclosed by Hagenauer. Significantly, in Fig. 4 of Hagenauer, the interleaving is clearly performed after the RCPC coding which by definition includes puncturing. If Frenger contemplated any other order than that of Hagenauer, he surely would have expressly stated this other order. There is nothing in Frenger that even remotely suggests altering this order taught by Hagenauer. He does not mention, discuss or hint at any order or timing of the rate matching and interleaving operations. Specifically, Frenger does not teach or hint that interleaving is performed before or within coding. It is submitted that Frenger by implication adopts the order of coding, which includes rate matching, then interleaving disclosed by Hagenauer.

The Applicants' admitted prior art merely discloses (1) a coding device in which, first, the number of bits is increased, and then, the bits are rearranged in an interleaver, and (2) a decoding device in which the received data is first deinterleaved and then punctured. This is opposite to the order of the claimed invention which recites coding including interleaving and then rate matching and decoding including rate matching and then deinterleaving.

C. <u>The Rationale of the Rejections</u>

With respect to the rejection of the transmission claims (claims 11-13, 19, 21-25, 31, 33, 34, 36, 38, 41 and 43), the final rejection notes that (1) Chen discloses coding and interleaving, and alleges that (2) Frenger discloses a "rate matcher" (while erroneously asserting that this "rate matcher" includes both a repeater and a puncturer and ignoring the fact that this "rate matcher" is in fact a rate compatible punctured <u>convolutional encoder</u>). The final rejection then concludes in the sentence bridging pages 2 and 3:

> "Therefore, it would have been obvious...to incorporate the rate matching including a repeater and a puncturer as taught by Frenger et al into the invention of Chen et al to repeat or puncture a part of the bits interleaved by the interleaver to provide flexible and efficient method for source data rate matching."

In other words, the final rejection proposes that it would have been obvious to modify Chen's Fig. 1 system to incorporate a "rate matching" section as taught by Frenger between interleaver 115 and modulator 116.

The sole motivation alleged in the final rejection for incorporating Frenger's convolutional encoder into Chen's system is found in the sentence bridging pages 2 and 3 "to provide flexible and efficient method for source data rate matching."

The Advisory Action states at page 2 that:

> "Applicant argues that Frenger does not disclose or suggest puncturing performed after interleaving and if (sic-in) the combination of Chen and Frenger (in view of the Hagenauer article cited by Frenger), the puncturing would be performed within the coding before interleaving. Examiner disagrees with applicant because we can't make a conclution (sic-conclusion) based on the cited reference of Hagenauer article cited by Frenger that the puncturing would be performed within the coding before interleaving. In fact, Frenger neither discloses that the puncturing (rate matching) is performed before or after interleaving. However, it would have been obvious ... to set the rate matcher to either the rate matching followed by interleaving is performed after convolutional code after coding to reduce latency or interleaving followed by rate matching is performed after convolutional coding to reduce burst error. Therefore, it would have been obvious...to combine the rate matching of Frenger into the interleaving performed after coding of Chen to rate match for reducing burst error. Thus, the combination of Chen and Frenger would be performed the interleaving before the rate

> matcher. (See the final office action dated on April 20, 2005)."

The Appellant notes that the statement "rate matching followed by interleaving is performed after convolutional code after coding to reduce latency" is unclear. And the mention of a motivation to "reduce burst error" is unsupported by any reasoning or any citation of anything in any of the references that would have suggested such a motivation. See, *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). The sole source for this motivation is found in the Appellant's own application. Thus, the alleged motivation is based on improper hindsight given that the motivation is not provided by the prior art but rather by the Appellant's own invention. See, *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303, 313 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984).

Furthermore, there is nothing in either the final rejection or the advisory action that discusses any motivation for incorporating interleaving from Frenger into Chen. This fact renders moot the issue of whether Frenger adopts interleaving then coding discussed above.

With respect to the rejection of the reception claims (claims 20, 32, 35, 37, 39, 40, 42 and 44), the final rejection relies on the same teachings of Chen and Frenger as discussed above. The

final rejection admits that Chen and Frenger do not disclose "employing a second rate matcher that comprises a second repeater and a second puncturer to alternatively select between second repeater and second puncturer...; and performing deinterleaving of data including bits provided by the second rate matcher." The final rejection relies on the admitted prior art as teaching this subject matter, stating: "Therefore, it would have been obvious...to incorporate the steps of employing a second rate matcher that comprises a second repeater and a second puncturer to alternatively select between second repeater and second puncturer...; and performing deinterleaving of data including bits provided by the second rate matcher as taught by the admitted prior art into the invention of Chen et al and Frenger et al in order for adjusting coded data to frame length."

The final rejection thus asserts in effect that it would have been obvious to incorporate the steps of employing a second rate matcher that punctures bits repeated by the rate matcher of the transmission method and performing deinterleaving of data including bits provided by the second rate matcher, as taught by the admitted prior art, into the invention of Chen et al and Frenger et al in order for adjusting coded data to frame length.

The alleged motivation for the combination is found at page 4, lines 12-13 of the final rejection as "adjusting coded data to frame length." However, this statement provides no reason for selecting a <u>timing</u> for the rate matching, i.e., either before or after deinterleaving. The statement merely assumes that the rate matching occurs before the deinterleaving step. Thus, the alleged motivation ignores the critical aspect of the invention relating to the order of the deinterleaving and rate matching steps.

With respect to the reception claims 32, 35, 37, 39, 40, 42 and 44, the final rejection states at page 4, lines 14-15 that the rationale directed to claim 20 also applies to claims 32 and 40.

D. <u>The Rejection of Independent Claims 23 and 31 Based on the Combined Teachings of Chen and Frenger is Unwarranted and Should be Reversed</u>.

The rejection should be reversed for the following reasons:

(1) it would not have been obvious to incorporate a convolutional encoder with embedded rate matching of Frenger into the system of Chen to achieve the present claimed invention,

(2) even if the teachings of Chen and Frenger were combined, the result would lack essential elements of the claimed invention and thus would fail to provide a basis for a *prima facie* rejection,

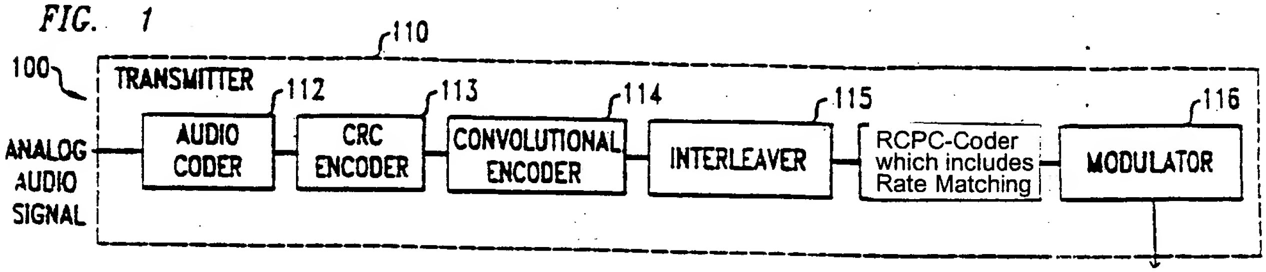
(3) the final rejection fails to assert a sufficient motivation for the proposed modification of Chen in view of Frenger, and

(4) the combination of Chen and Frenger is based on improper hindsight.

1. <u>It Would Not Have Been Obvious to Incorporate a Convolutional Encoder with Embedded Rate Matching as Taught by Frenger into the Chen Apparatus to Achieve the Present Claimed Invention</u>.

As noted above, the final rejection proposes that it would have been obvious to incorporate the "rate matching" taught by Frenger into the invention of Chen to repeat or puncture a part of the bits interleaved by the interleaver to provide a flexible and efficient method for source data rate matching. In other words, the final rejection proposes that it would have been obvious to modify Chen's Fig. 1 system to incorporate a "rate matching" section as taught by Frenger between interleaver 115 and modulator 116, as illustrated in the modified version of Chen's transmitter 100 shown below:

FIG. 1



The Appellant respectfully submits that this proposal is unfounded for the reasons set forth below.

Chen's FIG. 1 shows a system wherein ECC encoded symbols from

convolutional encoder 114 are interleaved in interleaver 115 and then applied to modulator 116.

Frenger discloses a rate-compatible punctured convolutional (RCPC) encoder, that is, a convolutional coder with a puncturing matrix and an alternative convolutional coder using a fixed convolutional code that is concatenated with a repetition code for rate matching purposes. Thus, Frenger discloses two different convolutional encoders with embedded rate matching.

Thus, what the final rejection deems a "rate matcher" in Frenger is actually a convolutional encoder including a rate matching function.

The proposal in the final rejection to incorporate a convolutional encoder as taught by Frenger after the interleaver 115 of Chen's Fig. 1 circuit makes no sense because Chen already has a convolutional encoder 114. This proposal would modify Chen's Fig. 1 system to include two convolutional encoders with an interleaver interposed therebetween, as shown in the above drawing. Such an arrangement would not have been contemplated by those skilled in the art. There is nothing in the prior art that would motivate such an arrangement.

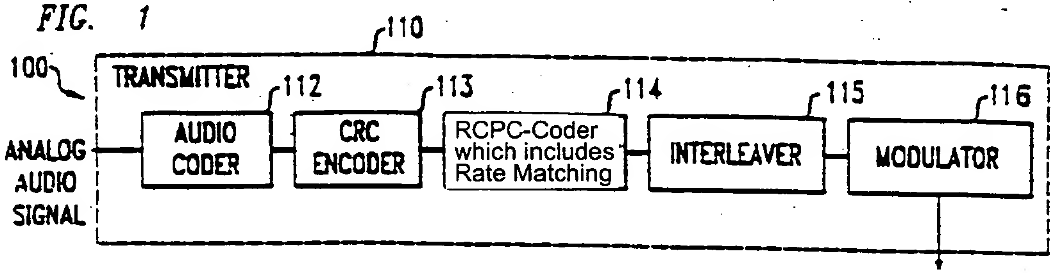
The final rejection does not discuss the possibility of employing the puncturing matrices taught by Frenger on the output of the interleaver 115 of Chen to achieve rate matching. Even

apart from the issue of whether it is technically possible to apply such matrices to the interleaver's output, the Appellant submits that there is no suggestion or motivation anywhere in the prior art to extract only a part of Frenger's system and apply it in this way.

In fact, considering the motivation of providing Chen with rate matching, the simple solution that could have occurred to those skilled in the art would be to use the admitted prior art solution of Fig. 1A to rate match then interleave. The sole difference between the scheme of Chen's Fig. 1 and the scheme of admitted prior art Fig. 1A is that Fig. 1A has a repetition section 4 inserted between error correction coder 3 and interleaving section 5. Accordingly, having an objective of achieving rate matching in Chen and considering the teachings of Frenger and the admitted prior art, those skilled in the art could no doubt have considered making a simple modification of Chen to include a rate matcher before the interleaver as in Fig. 1A. The final rejection offers no explanation of why those skilled in the art would be motivated to use the rate matching of Frenger, rather than that of the admitted prior art, for combination with Chen. It is submitted that the only explanation for the selection of Frenger's RCPC-coder for a modification of Chen is the use of impermissible hindsight.

Moreover, even if it were assumed *arguendo* that those skilled in the art would have considered modifying Chen in view of Frenger to obtain a system providing rate matching, the logical step would have been to substitute Frenger's rate-compatible punctured <u>convolutional encoder</u> for <u>convolutional encoder</u> 114 of Chen, thus resulting in rate-matching before interleaving in section 115 of Chen, or they would have substituted Frenger's alternative rate-matching <u>convolutional encoder</u> substituted for Chen's <u>coder</u> 114, again resulting in rate matching prior to interleaving, as illustrated in the modified version of Chen's transmitter 100 shown below:

FIG. 1



Moreover, the final rejection does not even propose incorporation of Frenger's interleaving operation into Chen. It is clear that Frenger's incidental mention of interleaving would not have led those skilled in the art to incorporate Frenger's interleaving into Chen's system. Frenger is primarily directed to a convolutional encoder with embedded rate matching, and he discusses "interleaving" only incidentally. While mentioning

interleaving, he does not discuss the interleaving in relation to the convolutional encoding. Nor does he disclose the timing of the interleaving. Neither the final rejection nor the advisory action asserts any alleged motivation to incorporate interleaving from Frenger into Chen. Even if Frenger's convolutional encoder were substituted for Chen's convolutional encoder as discussed above, there would have been no motivation to incorporate any of the interleaving mentioned in Frenger because Chen already includes an interleaver 115.

Thus, it is a moot point whether interleaving is performed before or after the convolutional encoding which includes rate matching in Frenger. This is because those skilled in the art, even if they were to substitute Frenger's convolutional encoder for that of Chen, would not have been motivated to incorporate any further interleaving into Chen's system beyond that of interleaver 115.

For at least the above reasons, it is submitted that it would have been unobvious to modify Chen in view of Frenger as suggested in the final rejection and advisory action. Thus, the obviousness rejection is unwarranted and should be reversed.

2. <u>Even if the Teachings of Chen and Frenger Were Combined, The Result Still Would Not Have Achieved or Suggested the Operations Performed in the Order Recited in Claims 23 And 31</u>.

It is submitted that a combination of Chen and Frenger would not have disclosed or suggested the present claimed invention.

Even if Chen and Frenger were combined, "puncturing" would be performed within the coding before "interleaving," and "repeating" would be performed before interleaving, because the convolutional encoder is <u>concatenated with</u> a repetition encoder. This is clear from points (1)-(4) below:

(1) Chen discloses "interleaving" performed after channel "coding" and is silent with respect to rate-matching.

(2) Frenger teaches rate-matching using rate-compatible punctured convolutional codes (RCPC-codes), and he discusses an

(3) Frenger's order would involve rate-matching then interleaving because:

(a) he discloses "puncturing" that is performed <u>within</u> the channel "coding" scheme which is based on RCPC encoding, thus permitting an interleaver to operate only on the output of the RCPC encoder,

(b) he discusses repeating involving a convolutional encoder <u>concatenated with</u> a repetition encoder, thus excluding an interleaver interposed between the concatenated convolutional encoder and repetition encoder, and

(c) he cites and implicitly adopts Hagenaurer's order of <u>rate-matching then interleaving</u> given that his technique is founded upon the Hagenaurer article which discloses (see Fig. 4) that

"interleaving" is performed after RCPC encoding which includes puncturing.

(4) Frenger lacks any discussion at all of altering the order taught by Hagenauer (RCPC encoding which includes rate-matching, and then interleaving).

The Applicants' admitted prior art (AAPA) merely discloses a coding device in which, first, the number of bits is increased, and then, the bits are rearranged in an interleaver. This is opposite to the order of the claimed invention (interleaving then rate matching) and thus the AAPA clearly does not cure the deficiencies of Chen and Frenger.

Accordingly, it is submitted that a system based upon the combined teachings of Chen and Frenger fails to achieve the order of the operations recited in present claims 23 and 31.

Thus, for at least this reason, it is submitted that the obviousness rejection is unwarranted and should be reversed.

3. <u>The Final Rejection and Advisory Action Fail to Assert a Sufficient Motivation for Combining the Teachings of Chen and Frenger to Achieve the Claimed Invention</u>.

Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. *In re*

Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

As noted above, the sole motivation alleged in the final rejection is found in a sentence bridging pages 2 and 3:

> "Therefore, it would have been obvious...to incorporate the rate matching including a repeater and a puncturer as taught by Frenger et al into the invention of Chen et al to repeat or puncture a part of the bits interleaved by the interleaver *to provide flexible and efficient method for source data rate matching.*" (emphasis added)

The quoted language "to provide flexible and efficient method for source data rate matching" is found at page 354, lines 39-41 of Frenger and refers to the use of RCPC-codes in general and not to anything having to do with repetition before or after interleaving. That is, the quoted statement provides <u>no reason</u> for selecting a <u>timing</u> for rate matching, i.e., either before or after Chen's interleaving step. The final rejection merely <u>assumes</u> that the rate matching occurs after the interleaving. Thus, the alleged motivation ignores the critical aspect of the invention relating to the order of the interleaving and rate matching steps.

The Advisory Action states at page 2 that:

> "Applicant argues that Frenger does not disclose or suggest puncturing performed after interleaving and if (sic-in) the combination of Chen and Frenger (in view of the Hagenauer article cited by Frenger), the puncturing would be performed within the coding before

> interleaving. Examiner disagrees with applicant because we can't make a conclution (sic-conclusion) based on the cited reference of Hagenauer article cited by Frenger that the puncturing would be performed within the coding before interleaving. In fact, Frenger neither discloses that the puncturing (rate matching) is performed before or after interleaving. However, it would have been obvious ... to set the rate matcher to either the rate matching followed by interleaving is performed after convolutional code after coding to reduce latency or interleaving followed by rate matching is performed after convolutional coding to reduce burst error. Therefore, it would have been obvious...to combine the rate matching of Frenger into the interleaving performed after coding of Chen to rate match for reducing burst error. Thus, the combination of Chen and Frenger would be performed the interleaving before the rate matcher. (See the final office action dated on April 20, 2005)."

The language "obvious ... to set the rate matcher to either the rate matching followed by interleaving is performed after convolutional code after coding to reduce latency..." is unclear. And the mention of a motivation to "reduce burst error" is unsupported by any reasoning or any citation of anything in any of the references that would have suggested such a motivation to those skilled in the art. The sole source for this motivation is found in the Appellant's own application. Thus, even the alleged motivation of reducing burst errors is based on improper hindsight given that the motivation is not provided by the prior art but rather by the Appellant's own invention.

Further, as noted above, the final rejection and advisory action fail to assert any motivation at all to incorporate interleaving from Frenger into Chen.

Due to these deficiencies, it is clear that the final rejection lacks any description of sufficient motivation for modifying the teachings of Chen in view of Frenger to achieve the present claimed invention.

E. <u>The Rejection of Claims 11 and 19 Based on the Combined Teachings of Chen and Frenger is Unwarranted and Should Be Reverssed.</u>

These claims are allowable for all of the reasons that claims 23 and 31 are allowable and for the further reason that the teachings of Chen and Frenger fail to disclose or render obvious the feature of claims 11 and 19 of rate matching by alternatively selecting between (i) repeating a part of the interleaved bits and (ii) puncturing a part of the interleaved bits.

The Final Rejection erroneously alleges at page 2, lines 23-24, that "Frenger et al disclose a rate matcher that comprises a repeater and a puncturer." However, the "repetition" of Frenger is merely a reference point to prove the higher performance of "puncturing" (see Section V, page 357 of Frenger). Frenger fails to teach performing, <u>in a single apparatus</u>, rate-matching by alternatively selecting between repeating and puncturing. And

there is nothing in Frenger which suggests combining repeating and puncturing in a single rate-matching device.

Thus, the combined teachings of Chen and Frenger do not disclose or suggest the subject matter recited in claims 11 and 19 directed to performance of rate matching including "alternatively selecting between (i) repeating a part of the interleaved bits and (ii) puncturing a part of the interleaved bits."

For at least the above, reasons, it is submitted that claims 11 and 19 are allowable over the combined teachings of the applied art.

F. <u>The Rejection of Claims 32 and 40 Based on the Combined Teachings of Chen, Frenger and the Admitted Prior Art is Unwarranted and Should Be Reversed.</u>

The final rejection states that the rationale in Section 3 directed to claim 20 also applies to claims 32 and 40.

With respect to claim 20, Section 3 of the final rejection admits that Chen and Frenger do not disclose "employing a second rate matcher that comprises a second repeater and a second puncturer to alternatively select between second repeater and second puncturer...; and performing deinterleaving of data including bits provided by the second rate matcher." The final rejection relies on the admitted prior art as teaching this subject matter. The final rejection states: "Therefore, it would have been

obvious...to incorporate the steps of employing a second rate matcher that comprises a second repeater and a second puncturer to alternatively select between second repeater and second puncturer...; and performing deinterleaving of data including bits provided by the second rate matcher as taught by the admitted prior art into the invention of Chen et al and Frenger et al in order for adjusting coded data to frame length."

The final rejection thus appears to assert in effect that it would have been obvious to incorporate the steps of employing a second rate matcher that punctures bits repeated by the rate matcher of the transmission method and performing deinterleaving of data including bits provided by the second rate matcher, as taught by the admitted prior art, into the invention of Chen et al and Frenger et al in order for adjusting coded data to frame length.

However, the Appellant notes that the admitted prior art merely discloses (1) a coding device in which, first, the number of bits is increased, and then, the bits are rearranged in an interleaver, and (2) a decoding device in which the received data is first deinterleaved and then punctured. This is opposite to the order of the claimed invention which recites coding including interleaving then repeating and decoding including puncturing and then deinterleaving. Thus, the admitted prior art clearly does not cure the deficiencies of Chen and Frenger.

Further, the sole alleged motivation for the combination is found at page 4, lines 12-13 of the final rejection as "adjusting coded data to frame length." However, this statement provides no reason for selecting a <u>timing</u> for the rate matching, i.e., either before or after deinterleaving. The rejection merely <u>assumes</u> that the rate matching occurs before the deinterleaving step. Thus, the stated motivation ignores the critical aspect of the invention relating to the order of the deinterleaving and rate matching steps.

Accordingly, the final rejection lacks a sufficient description of motivation.

For at least the above, reasons, it is submitted that claims 32 and 40 are allowable over the combined teachings of the applied art.

G. <u>The Rejection of Claims 20 and 35 Based on the Combined Teachings of Chen, Frenger and the Admitted Prior Art is Unwarranted and Should Be Reversed.</u>

These claims are allowable for all of the reasons that claims 32 and 40 are allowable and for the further reason that the teachings of Chen and Frenger fail to disclose or render obvious the feature of claims 20 and 35 of employing a second rate matcher that comprises a second repeater and a second puncturer to alternatively select between (i) using the second repeater to

repeat bits punctured by the puncturer employed in the radio transmission method and (ii) using the second puncturer to puncture bits repeated by the repeater employed in the radio transmission method.

As noted above, the Final Rejection erroneously alleges at page 2, lines 23-24, that "Frenger et al disclose a rate matcher that comprises a repeater and a puncturer." However, the "repetition" of Frenger is merely a reference point to prove the higher performance of "puncturing" (see Section V, page 357 of Frenger). Frenger fails to teach performing, <u>in a single apparatus</u>, rate-matching by alternatively selecting between repeating and puncturing. And there is nothing in Frenger which suggests combining repeating and puncturing in a single rate-matching device. Nor does the admitted prior art teach or suggest this subject matter.

Thus, the combined teachings of Chen, Frenger and the admitted prior art do not disclose or suggest the subject matter recited in claims 20 and 35 directed to employing a second rate matcher that comprises a second repeater and a second puncturer to alternatively select between (i) using the second repeater to repeat bits punctured by the puncturer employed in the radio transmission method and (ii) using the second puncturer to puncture bits repeated by the repeater employed in the radio transmission method.

For at least the above, reasons, it is submitted that claims 20 and 35 are allowable over the combined teachings of the applied art.

IX. CONCLUSION

In view of the law and facts stated herein, it is respectfully submitted that all pending claims define patentable subject matter. Therefore, reversal of all outstanding grounds of rejections is respectfully solicited.

Respectfully submitted,

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X. APPENDIX: THE CLAIMS ON APPEAL

11. A radio transmission apparatus comprising:

a coder that performs error correction coding of input data including a plurality of bits;

an interleaver that performs interleaving of said bits coded by said coder; and

a rate matcher that comprises a repeater and a puncturer, wherein said rate matcher alternatively selects between (i) employing said repeater to repeat a part of said bits interleaved by said interleaver and (ii) employing said puncturer to puncture a part of the bits interleaved by said interleaver.

12. The radio transmission apparatus according to claim 11, wherein said coder performs said error correction coding of said input data to provide error correction coded data and said interleaver performs the interleaving of the error correction coded data.

13. The radio transmission apparatus according to claim 11, wherein said repeat and said puncture of the part of the bits are performed at regular intervals.

19. A radio transmission method comprising:

(a) performing error correction coding of input data including a plurality of bits;

(b) performing interleaving of said bits coded in step (a);

(c) employing a rate matcher that comprises a repeater and a puncturer to alternatively select between (i) using said repeater to repeat a part of bits interleaved in step (b) and (ii) using said puncturer to puncture a part of the bits interleaved in step (b); and

(d) transmitting data including bits provided by said rate matcher in step (c).

20. A radio reception method comprising:

(a) receiving data including a plurality of bits transmitted by the radio transmission method of claim 19;

(b) employing a second rate matcher that comprises a second repeater and a second puncturer to alternatively select between (i) using said second repeater to repeat bits punctured by said puncturer employed in said radio transmission method and (ii) using said second puncturer to puncture bits repeated by said repeater employed in said radio transmission method; and

(c) performing deinterleaving of data including bits provided by said second rate matcher in step (b), in accordance with the

interleaving performed in said radio transmission apparatus.

21. The radio transmission apparatus according to claim 11, wherein said rate matcher performs adjustment of a length of data interleaved by said interleaver.

22. The radio transmission apparatus according to claim 11, further comprising a transmitter that transmits data including bits provided by said rate matcher.

23. A radio transmission apparatus comprising:

a coder that performs error correction coding of input data including a plurality of bits;

an interleaver that performs interleaving of said bits coded by said coder;

a rate matcher that repeats a part of bits interleaved by said interleaver.

24. The radio transmission apparatus according to claim 23, wherein said coder performs said error correction coding of said input data to provide error correction coded data, and said interleaver performs said interleaving of the error correction coded data.

25. The radio transmission apparatus according to claim 23, wherein said rate matcher repeats said part of bits at regular intervals.

31. A radio transmission method comprising:

(a) performing error correction coding of input data including a plurality of bits;

(b) performing interleaving of said bits coded in step (a);

(c) employing a rate matcher that repeats a part of bits interleaved in step (b); and

(d) transmitting data including bits provided by said rate matcher in step (c).

32. A radio reception method comprising:

(a) receiving data including a plurality of bits transmitted by the radio transmission method of claim 31;

(b) employing a second rate matcher that punctures bits repeated by said rate matcher employed in said radio transmission method; and

(c) performing deinterleaving of data including bits provided by said second rate matcher in step (b), in accordance with the interleaving performed in said radio transmission apparatus.

33. The radio transmission apparatus according to claim 23, wherein said rate matcher performs adjustment of a length of data interleaved by said interleaver.

34. A radio transmission apparatus according to claim 23, further comprising a transmitter that transmits data including bits provided by said rate matcher.

35. A radio reception apparatus comprising:

a receiver that receives data including a plurality of bits transmitted from the radio transmission apparatus of claim 22;

a second rate matcher that comprises a second repeater and a second puncturer, wherein said second rate matcher alternatively selects between (i) employing said second repeater to increase bits punctured by said puncturer of said radio transmission apparatus and (ii) employing said second puncturer to puncture bits repeated by said repeater of said radio transmission apparatus; and

a deinterleaver that performs deinterleaving of data including bits provided by said rate matcher of said radio reception apparatus, in accordance with the interleaving performed in said radio transmission apparatus.

36. A communication terminal apparatus comprising the radio transmission apparatus of claim 22.

37. A communication terminal apparatus comprising the radio reception apparatus of claim 35.

38. A base station apparatus comprising the radio transmission apparatus of claim 22.

39. A base station apparatus comprising the radio reception apparatus of claim 35.

40. A radio reception apparatus comprising:

a receiver that receives data including a plurality of bits transmitted from the radio transmission apparatus of claim 34;

a second rate matcher that puncture bits repeated by said repeater of said radio transmission apparatus; and

a deinterleaver that performs deinterleaving of data including bits provided by said second rate matcher, in accordance with the interleaving performed in said radio transmission apparatus.

41. A communication terminal apparatus comprising the radio transmission apparatus of claim 34.

42. A communication terminal apparatus comprising the radio reception apparatus of claim 40.

43. A base station apparatus comprising the radio transmission apparatus of claim 34.

44. A base station apparatus comprising the radio reception apparatus of claim 40.